

REMARKS

Claims 1, 2, 4-10, 12-17, 19, 20, 22 and 24-30 were previously pending in this application. Claims 1, 4, 5, 7, 9, 16, 17, 19, 24, 25 and 29 are currently amended. No claims are added or canceled. Claims 1, 2, 4-10, 12-17, 19, 20, 22 and 24-30 remain pending.

35 U.S.C. § 112 and 35 U.S.C. § 101 Rejections

Claims 1, 9, 16, 20 and 24 stand rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In addition, claim 1, 9 and 16 stand rejected under 35 U.S.C. 101 as being directed to non-statutory subject matter.

Applicant respectfully traverses the rejections.

Claim 1

Claim 1 has been amended to recite a method of maintaining a self-tuning histogram. The histogram is defined to have “a plurality of existing buckets arranged in a hierarchical manner and defined by at least two bucket boundaries that represent a range of attribute values, a bucket volume, and a bucket frequency that corresponds to a number of tuples having attribute values that fall in the bucket boundary range.”

The method includes a step of “creating at least one new bucket in response to a query on the database, each new bucket having bucket boundaries corresponding to a range of tuple attribute values returned by the query and a bucket frequency corresponding to a number of tuples returned by the query.”

The method further includes steps of “establishing a logical relationship between the new bucket and an existing bucket such that the existing bucket is a parent bucket of the new bucket” and “storing the self-tuning histogram that includes the new bucket in memory.”

Claim 1 further recites that the “bucket boundaries of each new bucket fall within bucket boundaries of the parent bucket of the new bucket.”

The amendments to claim 1 provide a clear statement as to the precise steps of the method that is claimed, thus overcoming the rejection under § 112. Furthermore, at least one step of claim 1 represents a tangible action. Therefore, the recited method is more than an abstract mathematical concept and the rejection under § 101 should be withdrawn.

For at least these reasons, claim 1 is allowable under the applicable statutes.

Claim 9

Claim 9 is currently amended and now recites a method a method of maintaining a self-tuning histogram. The histogram has “a plurality of existing parent buckets arranged in a hierarchical manner and defined by at least two bucket boundaries that represent a range of attribute values, a bucket volume, and a bucket frequency that corresponds to a number of tuples having attributes that fall in the bucket boundary range.”

The method comprises “examining the results of a query executed on the database,” “creating at least one candidate hole in the histogram based on the results of the query such that the candidate hole has boundaries corresponding to a range of attribute values returned by the query and a frequency corresponding to a number of

tuples returned by the query,” and “modifying the boundaries of each candidate hole such that the boundaries of the modified hole are completely contained within the boundaries of at least one existing parent bucket and do not partially intersect the boundaries of any existing bucket.”

The method further includes “creating a new child bucket that has a child frequency in the histogram corresponding to each modified hole” and “storing the modified self-tuning histogram in one or more computer-readable media.”

The amendments to claim 9 provide a clear statement as to the precise steps of the method that is claimed, thus overcoming the rejection under § 112. Furthermore, at least one step of claim 9 represents a tangible action. Therefore, the recited method is more than an abstract mathematical concept and the rejection under § 101 should be withdrawn.

For at least these reasons, claim 9 is allowable under the applicable statutes.

Claim 16

Claim 16 has been amended to recite one or more computer readable media having executable instructions that, when executed, implement a method “for maintaining a self-tuning histogram having a plurality of existing parent buckets arranged in a hierarchical manner and defined by at least two bucket boundaries that represent a range of attribute values, a bucket volume, and a bucket frequency that corresponds to a number of tuples having attribute values that fall in the bucket boundary range.”

The method comprises steps of “examining the results of a query executed on the database,” “creating at least one candidate hole in the histogram based on the results of the query such that the candidate hole has boundaries corresponding to a range of

attribute values returned by the query and a frequency corresponding to a number of tuples returned by the query,” and “modifying the boundaries of each candidate hole such that the boundaries of the modified hole are completely contained within the boundaries of at least one existing parent bucket and do not partially intersect the boundaries of any existing bucket.”

The method further comprises steps of “creating a new child bucket that has a child frequency in the histogram corresponding to each modified hole” and “storing the modified self-tuning histogram in one or more computer-readable media.”

The amendments to claim 16 provide a clear statement as to the precise steps of the method that is claimed, thus overcoming the rejection under § 112. Furthermore, at least one step of claim 16 produces a tangible result. Therefore, the recited method is more than an abstract mathematical concept and the rejection under § 101 should be withdrawn.

For at least these reasons, claim 16 is allowable under the applicable statutes.

Claim 20

The Office Action states that “Claim 20 is drawn to apparatus and claims a means for examining results of a query, means for creating at least one candidate hole, means for modifying the boundaries of each candidate hole. It is unclear what physical means Applicant is claiming.”

The Office Action explicitly states the rejection as being under the second paragraph of Section 112 for failing to particularly point out and distinctly claim the subject matter which application regards as the invention. However, use of the work “means” creates a presumption that § 112, sixth paragraph applies. Personalized Media

Communications LLC v. ITC, 161 F3d 696, 703, 48 USPQ2d 1880, 1886 (Fed. Cir.

1998). The sixth paragraph of Section 112 states:

An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material or acts described in the specification and equivalents thereof.

Applicant asserts that claim 20 is proper under the sixth paragraph of Section 112.

The specification clearly establishes what constitutes the means claimed.

Fig. 2 depicts a “Histogram Build/Refine Module” 63 that is a component of a relational database management system (RDBMS) 18. Applicant contends that it is this “Histogram Build/Refine Module” 63 that represents the means recited in claim 20.

Further description of the functionality of the “Histogram Build/Refine Module” 63 is found in the description corresponding to the flow diagram depicted in Fig. 4. “[M]eans for examining results of a query” is described with regard to block 420 (“Get Query Results”). Further description of block 420 is found on page 12 of the specification. “[M]eans for creating a candidate hole,” is represented in block 465 (“Drill Hole”) and is further described on page 14 of the specification. “[M]eans for modifying the boundaries of each candidate hole” is represented in block 460 (“Shrink Candidate Bucket”) and is further described on page 13 of the specification.

Applicant contends that the specification provides support for the means plus function elements recited in claim 20. Accordingly, claim 20 is allowable over the cited statute.

Claim 24

Claim 24, as amended, recites a histogram tuning system that comprises “a component that receives a histogram having at least a parent bucket” and “a tuning component that iteratively populates the parent bucket with a child bucket, as a function of query results, wherein the child bucket is completely contained within the parent bucket.”

The Office Action does not explicitly include claim 24 in its 112, second paragraph rejection. The Office claims that “Claim 24 is drawn to a system. It is unclear what component receives a bucket from the histogram and what comprises a tuning component.”

As previously noted above, in the response to the rejection of claim 20, the drawings (see Fig. 2) show a “Histogram Build/Refine Module” 63 as being included in a Relational Database Management System (“RDBMS”) 18. The functionality accorded the “Histogram Build/Refine Module” 63 is detailed in the specification.

Block 415 of Fig. 4 recites a “Get Histogram” step that Applicant contends stands for the step recited in claim 24 of receiving a histogram having at least a parent bucket. The component that performs this step is the “Histogram Build/Refine Module” 63 shown in Fig. 2. (See, Specification, page 12).

The “tuning component” recited in claim 24 is described in the first full paragraph of page 10 of the Specification. The final sentence of that paragraph reads “The online build/refine module 63 accesses the result 69 and in turn tunes the histograms 62 based on the query result 69.” Therefore, the “tuning component” is adequately identified.

Accordingly, claim 24 is allowable over the cited statute, and the rejection should be withdrawn.

35 U.S.C. § 103 Rejections

Claims 1, 4-7 and 24-30

Claims 1, 4-7 and 24-30 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,920,870 issued to Briscoe et al. (hereinafter "Briscoe") in view of U.S. Patent No. 6,507,840 issued to Ioannidis et al. (hereinafter "Ioannidis"). Applicant respectfully traverses the rejection.

Claims 1 and 4-7

Claim 1 has been amended to recite a method of maintaining a self-tuning histogram. The histogram is defined to have "a plurality of existing buckets arranged in a hierarchical manner and defined by at least two bucket boundaries that represent a range of attribute values, a bucket volume, and a bucket frequency that corresponds to a number of tuples having attribute values that fall in the bucket boundary range."

The method includes a step of "creating at least one new bucket in response to a query on the database, each new bucket having bucket boundaries corresponding to a range of tuple attribute values returned by the query and a bucket frequency corresponding to a number of tuples returned by the query."

The method further includes steps of "establishing a logical relationship between the new bucket and an existing bucket such that the existing bucket is a parent bucket of the new bucket" and "storing the self-tuning histogram that includes the new bucket in memory."

The buckets recited in claim 1 are limited to buckets that have at least two bucket boundaries. The bucket boundaries represent a range of attribute values, a bucket volume and a bucket frequency. The buckets disclosed in Briscoe bear no relation to the buckets recited in claim 1.

Briscoe uses the term “bucket” in an entirely different context. Briscoe clearly defines the terms “bucket” and “bucket objects” in column 7, lines 30-53, to-wit:

According to the present invention, *and in conformity with object oriented programming techniques*, a Bucket 40 corresponds to a class or grouping of related information while a Bucket Data Object 42 is a member of a Bucket 40 class and contains information belonging to that class or grouping of related information. (Emphasis added).

Therefore, while Briscoe defines a bucket as a “class” in object oriented programming terms, claim 1 requires specific characteristics, such as boundaries, frequency and volume. These characteristics make sense when viewed in light of the written description of the present application, i.e. in relation to histograms. To the contrary, there is no correlation between buckets having these characteristics and an object oriented programming class.

To further illustrate this point, consider an attempt to practice the teaching of claim 1 with a “bucket” (i.e. a class) as disclosed by Briscoe. It would be impossible to perform the method recited in claim 1 using Briscoe’s definition of a bucket.

Ioannidis does not teach or suggest working with buckets as required by claim 1 and, therefore, does not add to the present discussion.

Since neither of the cited references nor a combination thereof teach or suggest the use of buckets as defined and used in claim 1, the § 103 rejection must fail.

Accordingly, claim 1 is allowable over the cited references and the rejection thereof should be withdrawn.

Claims 4-7 depend from claim 1 and are allowable at least by virtue of that dependency. Therefore, the rejection of these claims should also be withdrawn.

Claims 24-30

Claim 24 recites a histogram tuning system that comprises “a component that receives a histogram having at least a parent bucket” and “a tuning component that iteratively populates the parent bucket with a child bucket, as a function of query results, wherein the child bucket is completely contained within the parent bucket.”

The Office Action claims that “[i]t would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Briscoe ‘870 to include a histogram as taught by Ioannidis ‘840.” Applicant disagrees.

As previously discussed with respect to claim 1, Briscoe’s description and use of the term “bucket” is incongruous with the term “bucket” as used in claim 24. Even with the advantage of the cited references, it could not be expected that one skilled in the art would seek to use “buckets” – as defined by Briscoe – with histograms. The “bucket” in Briscoe is a class in terms of well known principles of object oriented programming. Use of such a class is inconsistent with the use of histograms. Even if Briscoe’s “bucket objects” are said to equate to the “buckets” of claim 24, using the “bucket objects” with histograms would not be obvious. In fact, such a combination would not be beneficial or would even function in a manner required by claim 24.

For such a combination to function, it is incumbent upon the Office to show an element in either reference or in a combination of the references that “receives a

histogram having at least” a “bucket object” as defined by Briscoe. This simply does not make sense.

Accordingly, claim 24 is not taught or suggested by the cited references or by a combination thereof. As a result, claim 24 is allowable over the cited references and the rejection of claim 24 should be withdrawn.

Claims 25-29

Claims 25-29 depend from claim 24 and are allowable at least by virtue of that dependency. Accordingly, the rejection of these claims should also be withdrawn.

Claim 30

Claim 30 recites a “database histogram tuning system” that comprises “means for receiving a bucket from a histogram” and “means for iteratively populating the bucket with a child bucket, as a function of query results, such that the child bucket is fully contained within the received bucket.”

Claim 30 is similar to claim 24 and the analysis of the rejection with regard to the references is also similar. For the same reasons as discussed above, a combination of the buckets as defined by Briscoe and the histograms as defined by Ioannidis does not render claim 30 obvious.

Accordingly, claim 30 is allowable over the cited references and the rejection thereof should be withdrawn.

Claim 2

Claim 2 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Briscoe and Ioannidis and further in view of U.S. Patent No. 6,353,832

issued to Acharya et al. (hereinafter "Acharya"). Applicant respectfully traverses the rejection.

Claim 2 depends from claim 1 and is allowable at least by virtue of that dependency and for the same reasons discussed above, since the addition of the Acharya reference does not overcome the deficiencies of the combination of Briscoe and Ioannidis. Accordingly, the rejection of claim 2 should be withdrawn.

Claim 8

Claim 8 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Briscoe and Ioannidis and further in view of U.S. Patent No. 5,991,764 issued to Sundaresan (hereinafter "Sundaresan"). Applicant respectfully traverses the rejection.

Claim 8 depends from claim 1 and is allowable at least by virtue of that dependency and for the same reasons discussed above, since the addition of the Sundaresan reference does not overcome the deficiencies of the combination of Briscoe and Ioannidis. Accordingly, the rejection of claim 8 should be withdrawn.

Claims 9, 12-14, 16, 19, 20 and 22

Claims 9, 12-14, 16, 19, 20 and 22 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Briscoe and Ioannidis and further in view of Pub No US 2001/0010091 issued to Noy (hereinafter "Noy"). Applicant respectfully traverses the rejection.

Claims 9 and 12-14

Claim 9 has been amended and now recites a method a method of maintaining a self-tuning histogram. The histogram has "a plurality of existing parent buckets arranged

in a hierarchical manner and defined by at least two bucket boundaries that represent a range of attribute values, a bucket volume, and a bucket frequency that corresponds to a number of tuples having attributes that fall in the bucket boundary range.”

The method comprises “examining the results of a query executed on the database,” “creating at least one candidate hole in the histogram based on the results of the query such that the candidate hole has boundaries corresponding to a range of attribute values returned by the query and a frequency corresponding to a number of tuples returned by the query,” and “modifying the boundaries of each candidate hole such that the boundaries of the modified hole are completely contained within the boundaries of at least one existing parent bucket and do not partially intersect the boundaries of any existing bucket.”

The method further includes “creating a new child bucket that has a child frequency in the histogram corresponding to each modified hole” and “storing the modified self-tuning histogram in one or more computer-readable media.”

Similar to the language of claim 1, claim 9 recites specific characteristics of a “bucket” including “at least two bucket boundaries that represent a range of attribute values.” None of the cited references purports to deal with such a “bucket” structure. The “bucket” disclosed in Briscoe is a class of objects as used in standard object oriented programming techniques.

Since the “buckets” Briscoe do not even faintly resemble the “buckets” of claim 9, it would not have been obvious to combine the teachings of Briscoe with Ioaniddis or Noy to derive the elements recited in claim 9. Furthermore, combining the “buckets” or

“bucket objects” of Briscoe with either or both of the other references is impossible to do to perform the method recited in claim 9.

For at least this reason, claim 9 is allowable over the cited references and the rejection thereof should be withdrawn.

Claims 12-14 depend from claim 9 and are allowable at least by virtue of that dependency. Accordingly, the rejection of claims 12-14 should be withdrawn.

Claims 16, 19, 20 and 22

Claim 16, 20 and 22 each define a bucket has having “at least two bucket boundaries that represent a range of attribute values, a bucket volume, and a bucket frequency that corresponds to a number of tuples having attribute values that fall in the bucket boundary range. . . .”

For the same reasons cited above in the response to the rejections of claim 1 and claim 9, the cited references do not teach or suggest the elements recited in these claims. Specifically, none of the cited references teach or suggest the use of buckets having the recited characteristics. Only Briscoe discloses buckets, and those buckets are merely a class (or objects in such a class) according to principles of object oriented programming.

As a result, these claims are allowable over the cited references and the rejection of these claims should be withdrawn.

Claim 19 depends from claim 16 and is allowable at least by virtue of that dependency. Accordingly, the rejection of claim 19 should also be withdrawn.

Claims 10 and 17

Claims 10 and 17 are rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Briscoe, Ioannidis and Noy and further in view of Acharya.

Applicant respectfully traverses the rejection.

Claim 10 depends from claim 9 and **claim 17** depends from claim 16. Claims 9 and 16 have been shown to be allowable over the cited references. Claims 10 and 17 are allowable over the cited references at least by virtue of this dependency and the rejection thereof should be withdrawn.

Claim 15

Claim 15 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Briscoe, Ioannidis and Noy and further in view of Sundararesan.

Applicant respectfully traverses the rejection.

Claim 15 depends from claim 9 which has been shown to be allowable over the cited references. Claim 15 is allowable over the cited references at least by virtue of that dependency and the rejection of claim 15 should be withdrawn.

CONCLUSION

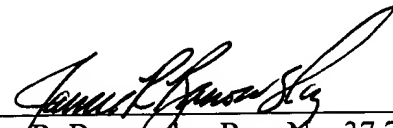
In view of the foregoing amendments and remarks, this application should now be in condition for allowance. A notice to this effect is respectfully requested. If the Examiner believes, after this amendment, that the application is not in condition for allowance, the Examiner is encouraged to call the Applicant's attorney at the telephone number listed below.

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If this response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicant hereby requests any necessary extension of time. If there is a fee occasioned by this response, including an extension fee, please charge any deficiency to **Deposit Account No. 50-0463**.

Respectfully submitted,
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